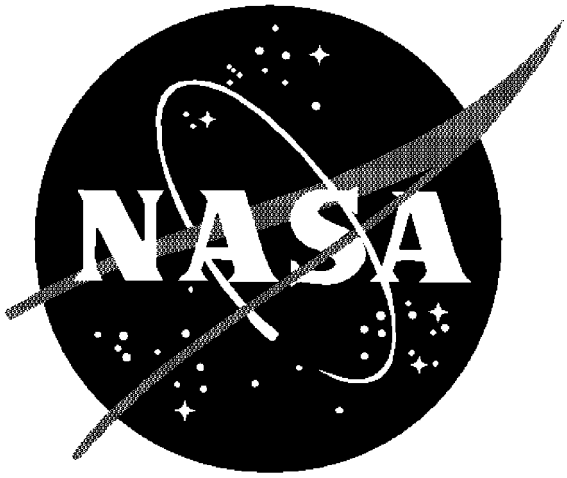

National Aeronautics and Space Administration

September 18, 2000

NRA-00-OES-07

RESEARCH ANNOUNCEMENT

GLOBAL WATER AND ENERGY CYCLE RESEARCH & ANALYSIS

Letters of Intent Due October 18, 2000
Proposals Due November 20, 2000

OMB Approval No. 2700-0087

GLOBAL WATER AND ENERGY CYCLE RESEARCH & ANALYSIS

NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
November 20, 2000

NRA 00-OES-07
Issued September 18, 2000

Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546

NASA RESEARCH ANNOUNCEMENT
GLOBAL WATER & ENERGY CYCLE (GWEC) RESEARCH AND ANALYSIS

NASA Earth Science Enterprise

The mission of NASA's Earth Science Enterprise (ESE) is to develop a scientific understanding of the Earth system and its response to natural or human-induced changes and improve prediction capabilities for climate, weather, global air quality and natural hazards. The Earth science research program aims to gain deeper insight by describing how the components of the Earth system function, how they interact, and how they may evolve in the future. These interactions occur on a continuum of spatial and temporal scales ranging from short-term weather to long-term climate variations, and from local and regional to global scales. The challenge is to develop the ability to predict climate changes that will occur in the next decade to century, both naturally and in response to human activities. The Enterprise also seeks to provide accurate assessments of changes in the composition of the atmosphere, the extent and health of the world's forest, grassland, and agricultural resources, and geologic and hydrologic phenomena that can cause natural hazards.

In general, the Enterprise aims to provide scientific answers to five challenging scientific and socially important Earth system science questions:

- Earth's natural variability: how is the global Earth system changing?
- Forcing factors: what are the primary forcings of the Earth system?
- Response to disturbances: how does the Earth system respond to natural and human-induced changes?
- Consequences: what are the consequences of change in the Earth system for human civilization?
- Prediction: how well can we predict changes in the Earth system that will take place in the future?

Over the past decades, the Earth Science Enterprise (ESE) and its antecedent programs (most recently, Mission to Planet Earth), have made major investments in space-based and sub-orbital observations, model development, and research conducted by the broad scientific community to address these scientific issues. In particular, NASA and partner agencies launched the Tropical Rain Measuring Mission (TRMM) in 1997; and QuikSCAT, Landsat 7, ACRIMSAT and Terra (EOS-AM) – the flagship of the Earth Observing System (EOS) program - in 1999; to be followed by Jason-1, Aqua (EOS-PM), ICESat, Aura (EOS-CHEM), SORCE and other missions. These spacecraft are expected to usher a new era of integrated scientific studies of the Earth system, as envisioned in the original plans for EOS and the US Global Change Research Program.

Purpose of this NASA Research Announcement

The cycling of water in the Earth system and the renewal of fresh water reserves are critical for both human populations and ecosystems. The ubiquitous nature of water makes the study of the water cycle an enormously complex subject, involving the entire coupled Earth system. Fluctuations in water cycling can induce severe weather and hydrologic extremes such as droughts and floods. These extremes have considerable impacts on the economic infrastructure, human health, and ecosystem integrity, that occur regionally and locally but are driven by global scale mechanisms. Human and ecosystem vulnerabilities to hydrological extremes can also be exacerbated locally by land use changes (e. g. deforestation), or mitigated by infrastructure adaptation and changes in water usage. Planning for mitigation of the effects of hydrologic extremes requires significant improvements in observational and predictive capabilities at annual, seasonal and shorter time scales.

The principal objective of this NASA Research Announcement (NRA) is to explore the connection between weather-related fast dynamical/physical processes that govern energy and water fluxes, and climate responses and feedbacks. Particularly significant is the transformation of water among its three physical states – vapor, liquid, and ice – in the atmosphere and at the surface of the Earth. The condensation of water in clouds and snow controls both the albedo and radiation balance of the planet, and the constant renewal of fresh water resources. The objective of this research is to address the water and atmospheric energy cycles as a single integrated problem. This approach includes exploring the response of regional hydrologic regimes (precipitation, evaporation, and surface run-off) to changes in atmospheric general circulation and climate, and the influence of surface hydrology (soil moisture, snow accumulation and soil freezing/thawing) on climate.

Specifically, the NRA is intended to advance knowledge and create new capabilities for providing definitive answers to key research questions such as:

- ***Is the global cycling of water through the atmosphere accelerating?***
- ***What are the effects of clouds and surface hydrologic processes on climate change?***
- ***How are variations in local weather, precipitation, and water resources related to global climate change?***
- ***To what extent can weather forecasting be improved by new global observations and advances in satellite data assimilation?***

Thus, the purpose of the NRA is to promote research that (1) aims to improve our understanding of the role of water and energy exchange processes in the global climate system, based on remote sensing and conventional observational capabilities, process studies, regional and global atmospheric/hydrologic modeling, and data analysis; and (2) builds on NASA investments, and leverages complementary investments by other US and international agencies, to address the key scientific issues associated with the global hydrologic cycle and its role in the Earth's climate system and consequences to society. (See Appendix A for a more detailed description of the research areas covered by this NRA.)

NASA's policy is to work cooperatively with other U.S. government agencies and our international partners in the development of a comprehensive capability to observe and understand the Earth. In addition, both National and NASA policy require NASA to support private-sector investment in commercial space activities by committing the U.S. government to purchase commercially available goods and services. NASA will not develop a mission that in any significant way competes with or duplicates planned commercial capabilities.

This solicitation seeks research proposals that address the interdisciplinary science questions outlined in Appendix A. In order to be responsive to the intent of this NRA, proposed investigations should embrace the interdisciplinary nature of scientific issues, rather than focusing on specialized problems that are covered by established Earth science disciplines and studied by NASA's Research & Analysis programs in meteorology, oceanography, geophysics, hydrology, terrestrial ecology, etc. Proposals which are judged insufficiently sensitive to these interdisciplinary issues will be considered non-responsive to this NRA.

Priority will be given to those proposals that illustrate the value of remotely sensed observations of water, in all its phases, in furthering understanding of the global water and energy cycles. Priority will also be given to proposals that collaborate with or otherwise contribute significantly to one or more core NASA modeling and data assimilation activity or activities. Such contributions could, for example, take the form of developing and testing a new parameterization scheme in a NASA model, testing an alternative component model in a coupled model system, validating simulations of water flow and radiant energy against observations, or using model output to identify significant climatic trends. Field measurements may be proposed inasmuch as they enhance the cross-disciplinary aspects and constitute a limited augmentation of already planned efforts that are consistent with the objectives of this solicitation.

This NRA is open to all scientific investigators who submit proposals that respond to the objectives of the program, and meet the other requirements stated in this announcement. Awards will be made for a period of up to three years for approved projects. Individual awards are expected to range form $100,000 to $200,000 per year for interdisciplinary research, including modeling studies, and global data synthesis and analysis investigations. It is anticipated that approximately 25 proposals will be approved. Funding for this NRA is anticipated to first become available in FY2001, but has not yet been appropriated. NASA reserves the right to cancel this NRA if adequate funds are not appropriated.

Participation in the program is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers and other US agencies. In accordance with NASA policy as described in Appendix B, all investigations by foreign participants will be conducted on a no-exchange-of-funds basis, i.e., investigators whose home institution is outside the United States cannot be funded by NASA.

Proposals may be submitted at any time during the period ending November 20, 2000. NASA reserves the right to consider proposals received after that date in accordance with Appendix B, item (g) if the selecting official deems the late proposal to offer significant technical advantage or

cost reduction. Proposals submitted to NASA will be evaluated using scientific peer review. Proposals selected for funding will be announced in early 2001.

Appendices B through E contain NASA general guidelines for the preparation of proposals solicited by this Research Announcement. All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement by October 18, 2000 as described in Appendix D. This will allow us to assess the range of expertise required to adequately support the proposal review process.

Identifier:	NRA 00-OES-07
Submit proposals to:	GWEC NRA NASA Peer Review Services, Code Y 500 E Street SW, Suite 200 Washington, DC 20024-2760 Tel: 202-479-9030
Number of Copies Required:	10
Selecting Official:	Director, Research Division Office of Earth Science NASA Headquarters
Obtain Additional Information From:	Dr. Michael F. Jasinski Hydrology Program Manager (Acting) NASA Headquarters, Code YS Washington, DC 20546 Tel: (202)-358-1847 Fax: (202)-358-2771 Email: mjasinsk@hq.nasa.gov

Please use identifier number NRA-00-OES-07 when making an inquiry regarding this announcement. Your interest and cooperation in participating in this effort are appreciated.

Original signed by

Dr. Ghassem R. Asrar
Associate Administrator
Office of Earth Science

NASA RESEARCH ANNOUNCEMENT
GLOBAL WATER & ENERGY CYCLE (GWEC) RESEARCH AND ANALYSIS

APPENDIX A: Technical Description and Specific Guidelines for this NRA

APPENDIX B: Instructions for responding to NASA Research announcements (NRA)

APPENDIX C:

1. Proposal Cover sheet
2. Certifications, Disclosures, and Assurances regarding lobbying, debarment and suspension, and drug-free workplace requirements

APPENDIX D: Letter of Intent

APPENDIX E: Budget summary

NASA RESEARCH ANNOUNCEMENT
GLOBAL WATER & ENERGY CYCLE (GWEC) RESEARCH AND ANALYSIS

APPENDIX A: TECHNICAL DESCRIPTION AND SCIENTIFIC GUIDELINES

Background

The study of the global water and energy cycles is a unifying theme that bridges the scale gap between global atmospheric and land surface hydrological processes (including evaporation from the global ocean) that together govern the availability of water resources. The goal is to create an integrated research program and to strengthen the scientific knowledge of water and energy cycle processes over a broad spectrum of scales, from global to regional and local, as well as the connections between those different scales. A further intention is to expand the understanding of the water cycle to include linkages to the cycling of carbon and other chemical species in the Earth system, and to predictions of water availability and streamflow, and its impacts on ecosystems.

Understanding the global water cycle is also crucial to the assessment of potential human, economic, and ecological consequences of global environmental change. Water is at the heart of both the causes and the effects of climate change. Ascertaining the rate of cycling of water in the Earth system, and detecting possible changes, is a first-order problem with regard to the renewal of water resources and hydrologic hazards. A more complete understanding of water fluxes, storage, and transformations in the land, atmosphere, and oceans will be the central challenge to the hydrological sciences in the 21st century. Improved knowledge and prediction of the water cycle can yield large benefits for resource management and regional economies if variability and uncertainties can be understood, quantified and communicated effectively to decision-makers and to the public. New observing methods show promise for monitoring the global water cycle. Remote sensing will play an increasing role, particularly at global scales. Data assimilation and model-assisted budget studies will be instrumental in filling observational gaps and assessing uncertainties.

The above research theme builds upon the scientific basis created by the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Program, the UNESCO/WMO Hydrology for the Environment, Life, and Policy (HELP) initiative, and the Biospheric Aspects of the Hydrological Cycle (BAHC) project of the International Geosphere-Biosphere Program. NASA's goal is to exploit its unique capabilities for global observations, data analysis and Earth system modeling in cooperation with USGCRP partner agencies. The overarching objective is to improve the understanding of the global water cycle to the point where useful predictions of regional hydrologic regimes can be made. This predictive capability is essential for practical applications to water resource management and for validating scientific advances through the test of real-life prediction.

Through this research announcement, NASA also seeks to contribute to the GEWEX Americas Prediction Project (GAPP) in the areas of land surface hydrologic processes and their influence

on the predictability of the coupled land-atmosphere system, and of development of scaling and transferability studies to extend and to generalize regional hydrologic understanding and predictability to all parts of the world. The latter theme is a central component of the GEWEX Coordinated Enhanced Observing Program (CEOP).

The key related scientific questions formulated by NASA follow. These are accompanied by examples of topics that are intended only to emphasize the interdisciplinary focus of this solicitation. They are not intended to constrain the scope of proposals.

Question 1: ***Is the global cycling of water through the atmosphere accelerating?***

According to model predictions, the most significant manifestation of climate change would be an acceleration of the global water cycle, leading to increased global precipitation, faster evaporation and a general exacerbation of extreme hydrologic regimes, floods and droughts. Since the release of latent heat associated with condensation is the principal source of energy for rapid cyclogenesis, a more active water cycle would be expected to generate more frequent and/or more severe weather disturbances, and to induce changes in water storage over land. Investigating the existence of significant global trends in the rate of the water cycle will rely primarily on diagnostic studies using remote sensing, *in situ* observations and modeling, of global atmospheric circulation, temperature, precipitable water content, vegetation change, evaporation, precipitation, and trends in water storage over land.

Examples of Potential Research Foci:

- Assessment of trends in the global transport and budgets of atmospheric water in all three phases (vapor, liquid, and ice), and corresponding changes in the global energy budget.
- Assessment of large-scale variability patterns and/or global trends in the occurrence of extreme hydrologic events (e.g., floods and droughts), based on the analysis of global remote sensing and *in situ* observational data.
- Estimation of evaporation fluxes over the land and oceans, based on the assimilation of relevant observational data, and advanced parameterizations of model sub-grid scale processes (e. g. planetary boundary layer dynamics).
- Diagnostics of spatial and temporal changes in the distribution of surface energy and water storage; diagnostics of atmospheric responses to changes in ocean and land boundary conditions.

Question 2: ***What are the effects of clouds and surface hydrologic processes on climate change?***

The dynamics of climate change are the result of a multiplicity of "fast", small-scale processes that evolve on meteorological time-scales in the atmosphere and at the surface of the Earth and, generally, govern mean flux quantities. Knowledge of those basic processes is essential in order to extrapolate model simulations from current climate conditions to significantly different states of the Earth system. The problem is synthesizing results from observations and process-

resolving model studies and developing adequate representations of those physical processes in atmospheric circulation and climate models.

The surface hydrologic processes that govern continental water budgets involve complex soil, vegetation and snow physical processes. Land surfaces interact with the air masses passing over them, through latent and sensible heat and radiative exchanges, modifying boundary layer development, circulation and precipitation patterns. A principal GAPP theme is to understand the extent to which those surface hydrologic processes and land surface states interact and modify the atmosphere and influence the predictability of weather and climate, using remote sensing and data assimilation techniques.

Examples of Potential Research Foci:

- Application of field measurements and global satellite observations to the development and testing of models of convective and non-precipitating clouds, with the aim of producing realistic model computations of precipitation, radiation fluxes, and flux divergence.
- Analysis of observational data and cloud ensemble model experiments to derive quantitative estimates of the effects of various classes of aerosols on cloud microphysical properties, cloud structure and lifetime, and their resulting impacts on rainfall.
- Use satellite remote sensing to improve land surface process modeling and the understanding of soil-vegetation-atmosphere interactions at regional or greater scales.
- Establish the interrelationships and feedbacks among clouds, precipitation, boundary layer, and land surface processes using improved coupled land-atmosphere models and assimilated data.
- Determine how land-atmosphere interactions, as affected by orography, vegetation, and soil, affect the predictability of large-scale terrestrial hydrology and atmospheric systems, including precipitation and runoff.

Question 3: ***How are variations in local weather, precipitation, and water resources related to global climate change?***

A central problem of climate science is relating changes in global-mean climatological state to the variability and intensity of weather, land surface processes and associated water availability (precipitation, runoff, soil moisture, snow, groundwater and lake storage, and evaporation). This climatic approach to hydrology, enabled by large-scale observation of hydrologic parameters, aims to achieve quantitative predictions of precipitation and runoff on all spatial scales, from global to the scale of individual river catchments used for fundamental hydrologic studies, strengthening the scientific basis for applications to water resource management. Essential for achieving that objective is the capability to observe and to model the global atmospheric circulation and land surface hydrology. To meet that goal, GEWEX and other international programs stress the critical need to extend hydrologic process modeling, developed for data rich regions such as GCIP/GAPP, to other data sparse regions of the world through transferability

studies that utilize remote sensing data from existing and new generation satellites (including TERRA, AQUA, Landsat, ADEOS, ENVISAT, NOAA-K series and TRMM).

Examples of Potential Research Foci:

- Analysis of observations-driven modeled global meteorological fields with the aim of identifying significant changes in weather statistics, storm tracks, and evaporation/precipitation patterns associated with large-scale climatic anomalies (e. g. ENSO, Arctic/North Atlantic Oscillation, variations in regional monsoon regimes).
- Characterization of the structure of mesoscale weather systems and associated precipitation, based on the combined analysis of field measurements (e.g. CAMEX, FASTEX), space-based observations (e. g. GOES, TRMM), and mesoscale numerical model simulations, with the aim of assessing how the properties and behavior of such systems might vary in a future altered atmosphere.
- Analysis of the effect of spring and early summer hydrologic anomalies (snow accumulation, soil moisture, soil freezing and thawing) on subsequent weather and precipitation patterns, and hydrologic phenomena (impacts on runoff, water storage, and inland water bodies), and how climate change might affect such anomalies in the future.
- Establish the scientific justification for future space-based observations of soil moisture, snow, surface water, or other hydrologic variables, through scientific analysis and field investigations, including the improvement in our understanding of the global water and energy cycle, floods and droughts, and climate change.
- Determine techniques for transferring regional (e.g. GAPP) hydrologic process understanding and prediction tools to other areas of the world, using remotely sensed and emerging Coordinated Enhanced Observing Period (CEOP) observations scheduled for 2001 to 2003..

Question 4: ***To what extent can weather forecasting be improved by new global observations and advances in satellite data assimilation?***

Accurate forecasting of weather has major significance for the protection of lives and property. Improving the accuracy of short-term predictions and increasing the period of validity of long-range forecasts is of great practical interest and is also a great scientific challenge. Scientific advances in climate and/or atmospheric general circulation models, and more effective methods for ingesting new types of observations, are directly applicable to the improvement of operational forecasting systems. Conversely, experience has shown that synergy between operational weather forecasting and atmospheric research is a powerful engine of progress for both validation of new scientific concepts and development of new prediction systems or products.

Examples of Potential Research Foci:

- Development of improved methods, including adjoint or inverse modeling techniques, for model-based assimilation of daily atmospheric, oceanic, and hydrologic data, aiming to produce more realistic analyses of the cycling of water through the Earth system, acquire

better understanding of the processes involved, and develop improved numerical representation of these processes.

- Development of methods for assimilation of new types of atmospheric/hydrologic observations or data products, and assessment of their impact on weather forecasting and climate prediction. New observational data sources may be Doppler weather radars, passive microwave sensors on operational and research satellites (TRMM; SSM/I; AMSR); geostationary imager/sounder data (e. g. GOES operational sounder; future GIFTS), lidar remote sensing systems (e. g. ICESat, CloudSat, PICASSO/CENA), and EOS Terra and Aqua data products in general.

Guidance for Proposers:

General instructions for submission of a proposal in response to this announcement are given in Appendix B. In addition, the following specific guidelines should be adhered to:

- Proposals should not exceed 15 pages of single-spaced pica 12 type, including figures, but excluding the cover page, abstract, a table of contents, bibliographical references, curriculum vitae, budget information and certifications. (Vitae should not exceed 3 pages per investigator including publications.) To facilitate recycling, proposals should be prepared on white paper using no binding material other than clips or staples. No plastic cover sheet should be used. If color figures are used, proposers should ensure that all copies of the proposal contain color copies of these figures.
- Proposals should be self-contained and should not refer to other materials, such as websites on the internet, not available in peer-reviewed publications. If color figures are included, they should be included in all copies provided. Attached preprints and reprints of publications and reports will be ignored in the review process.
- A work plan which describes the specific tasks for each year of the proposal should be included as part of the text.
- Cost for acquisition, storage or processing of data should be included as well as cost for any ancillary data acquisition and computer utilization. If use of a NASA supercomputer in anticipated, an estimate of computational requirements on relevant NASA systems should be given as part of the budget submission.
- NASA's Earth Science Enterprise has adopted commercial data purchases as a mainstream way of acquiring research-quality data, as these commercial capabilities become available. NASA encourages the use of commercially available data sets by Principal Investigators as long as it meets the scientific requirements and is cost-effective. When responding to a NASA Research Announcement, the proposer should identify the commercial data sources intended for use and the associated cost.
- Data requirements that could be fulfilled at no cost to the proposal through the existing data acquisition program of NASA's Commercial Remote Sensing Program (CRSP), should be identified. The CRSP can be accessed at: http://www.crsp.ssc.nasa.gov/databuy/dbmain.htm.

- All proposals should include a list of other U.S. Government agency support received and/or expected by the principal investigator and any co-investigators. Investigators who receive other support from the NASA Office of Earth Science should provide a clear statement of the relationship between this proposal and the other activities already funded by NASA.

The review of submitted proposals will be competitive. Proposals will be subject to both mail peer review and to the deliberations of a peer review panel. The proposed budgets and/or work plans may be negotiated with the responsible program managers in the light of the results of this review process. Approved proposals will normally be funded in annual installments for a period up to three years, subject to demonstrated satisfactory performance and the continued availability of funds. Funding of successful proposals is expected to start early in calendar 2001.

APPENDIX B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

NASA Federal Acquisition Regulation (FAR), Supplement (NFS) Part 1852.235-72 , Effective JANUARY 2000

(a) **General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) **NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) **Transmittal Letter or Prefatory Material.**

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
(vi) Identification of the NRA, by number and title, to which the proposal is responding;
(vii) Dollar amount requested, desired starting date, and duration of project;
(viii) Date of submission; and
(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice
Restriction on Use and Disclosure of Proposal Information

The information (data) contained in *[insert page numbers or other identification]* of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to

be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs (U.S. Proposals Only).**

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals.**

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing

organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) **Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA and, if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) **Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at http://www.pmdtc.org and http://www.bxa.doc.gov. Proposers are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles”

on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

(n) Cancellation of NRA.

(1) NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

Appendix C

Proposal Cover Sheet

NASA Research Announcement 00-OES-07
Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator::_____

Department:_____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ Congressional District:_____
(used for database sorting purposes only)

E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & Email Address	Address & Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:
1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and

- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i*) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and*
(ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

The *(Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant ")* hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

NASA FORM 1206

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES
REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding $ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (l)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Appendix D

Notice of Intent

All prospective proposers are *strongly* encouraged to submit a notice of intent in response to this NRA. This will facilitate planning of the peer review process. The notice of intent should be submitted via email to *OESresponse@hq.nasa.gov* or fax to 202-479-0511. The notice of intent should include the following information:

- NRA number
- PI and Co-I names and addresses (including zip + 4)
- Title of proposal
- Telephone and fax numbers of PI
- Email address
- Brief summary of the proposed work (not to exceed 300 words)

Appendix E

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See *Instructions For Budget Summary* on following page for details.

		NASA USE ONLY	
	A	**B**	**C**
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____
2. Other Direct Costs:			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____
7. Carryover Funds (if any)			
a. Anticipated amount : _____			
b. Amount used to reduce budget	_____	_____	_____
8. Total Estimated Costs	_____	_____	XXXXXXX
9. APPROVED BUDGET	XXXXXX	XXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.

2. Other Direct Costs:
    a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
    b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
    c. Equipment: List separately. Explain the need for items costing more than $5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
    d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
    e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
    f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. Other Applicable Costs: Enter total explaining the need for each item.

5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.

6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.

7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.